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CORRES. CONTROL
OUTGONG LTR NO.

DOE ORDER # 96RF05573

DIST.	LTR	ENC
Bengal, P.		
Benson, C. A.		
Burdelik, W. J.		
Evans, C. S.		
Findley, M.		
Guinn, L.		
Hopkins, J.	X	X
Jenkins, K.		
Jierree, C.		
Konwinski, G.		
Law, J. E.	X	X
Lovseth, T. P.	X	X
Luker, R.S.		
McAnally, J. L.		
Motyl, K. M.		
Primrose, A. L.	X	X
Power, A.		
Rukavina, F.		
Steffen, D. E.		
Tyson, A. M.	x	
Zeile, H.		
Cowdery, C	X	X
RMRS CC (080)	X	X
CORRES.CONTROL	X	X
TRAFFIC		

CLASSIFICATION

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RF-46469 (Rev. 04/96)

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RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, Colorado 80402-0464
Phone: (303) 966-2678
Fax: (303) 966-8244

September 27, 1996

96-RF-05573
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Ann K. Sieben
Kaiser-Hill, L.L.C.
Rocky Flats Environmental Technology Site
P. O. Box 464, Bldg. T130C
Golden, CO 80402-0464

IHSS 118.1 - CARBON TETRACHLORIDE SPILL SITE (KH00003NS1A) – JEL-207-96

Attached for your information is an internal RMRS memorandum containing a brief compilation of the information known about the subsurface and groundwater contamination related to the IHSS 118.1 Carbon Tetrachloride Spill Site.

If you have any questions or require additional information, please contact me at extension 4842, or Annette Primrose at extension 4385.

John E. Law

John E. Law, P.E.
Remediation Manager
Sitewide Actions

ALP:slm

Attachment:
As Stated

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ADMIN RECORD

IA-A-000732

IHSS 118.1 CARBON TETRACHLORIDE SPILL SITE

Setting and History

IHSS 118.1 - Carbon Tetrachloride Spill is an area of known subsurface soil contamination resulting from leaks and spills associated with an underground storage tank containing carbon tetrachloride. This IHSS is located due north of Building 776 and east of Building 730, in a highly developed area of the Rocky Flats Environmental Technology Site's (RFETS) Industrial Area, (Figure 1). While there are other IHSSs that overlap IHSS 118.1, (IHSSs 121-Tank 9, 121-Tank 10, 131, and 144[N]), the contamination in this area is primarily related to the carbon tetrachloride leaks and spills.

Surficial materials in the IHSS 118.1 area are predominantly artificial fill, composed mostly of reworked Rocky Flats Alluvium, along with some remaining undisturbed Rocky Flats Alluvium. The fill and undisturbed alluvium are primarily clay with interspersed unconsolidated gravels and sands. Immediately underlying the surficial material is the claystone bedrock of the Arapahoe Formation.

The area surrounding IHSS 118.1 has numerous underground and overhead utilities and structures. These include vitreous clay sanitary sewer lines, electrical lines, tunnels between buildings, process waste lines and process waste tanks. Information from excavations in other areas, and conversations with workers indicates that most of the buried utilities were backfilled using native materials.

Immediately east and partially overlapping IHSS 118.1 is a group of four process waste tanks referred to as tank groups T-9 and T-10 (the Tank Systems) (Figure 1). T-9 consists of two 22,500 gallon underground concrete storage tanks. T-10 consists of two 4,500 gallon concrete underground tanks. Both sets of tanks were installed in 1955 but are no longer used as process waste tanks. T-9 is currently being utilized as plenum deluge catch tanks for Building 776. No releases from either set of tanks has been documented (DOE 1995).

The underground, 5,000 gallon, steel, carbon tetrachloride storage tank was surrounded by a concrete containment structure. The tank was installed prior to 1970. Numerous surface spills occurred before 1970, some up to 200 gallons. The tank failed in June 1981, and released carbon tetrachloride into the containment structure. Carbon tetrachloride was pumped out of the containment structure onto the surrounding soil ground surface, and the tank was removed along with a limited amount of soil around the tank. The surrounding concrete containment structure was probably removed at this time, but this cannot be verified (DOE 1992).

Contaminants In Subsurface Soil and Groundwater

Carbon tetrachloride is a dense nonaqueous phase liquid (DNAPL) that tends to sink to the lowest possible depth. Therefore, the bedrock surface, building footing drains, and subsurface structures probably control the extent of the free-product plume as well as much of the dissolved phase portion of the contaminated groundwater plume.

The recent OU 9 Phase I Remedial Investigation found free-phase carbon tetrachloride in the subsurface soil and groundwater in the vicinity of IHSS 118.1. Soil borings were drilled near the four corners of the Tank Systems, and all borings intercepted free-phase carbon tetrachloride (Figure 1) (DOE 1995). When a water sample was collected at this location, the liquid separated into two, distinct phases. Other volatile organic compounds (VOCs) may be present, but are likely to be masked by the high concentrations of carbon tetrachloride.

Groundwater flow in this area is to the northeast towards Buildings 771 and 774. Portions of these buildings are constructed 20 to 30 feet below grade and have footing drains. Buildings 701 and 730 are not believed to have subsurface structures. Carbon tetrachloride and other VOCs have been detected in the groundwater from nearby wells indicating that a dissolved plume is moving through the groundwater. This contaminated groundwater plume may eventually reach the North Walnut Creek drainage, especially after the removal of the surrounding buildings (RMRS 1996).

A downgradient well (P210189) completed in the Arapahoe Number 1 Sandstone, due east of IHSS 118.1 at the western edge of the Solar Ponds, contains carbon tetrachloride concentrations up to 21,000 ug/l and trichloroethene up to 8,000 ug/l together with other VOCs. The carbon tetrachloride spill is believed to be the source of this contamination and indicates that the dissolved phase of the groundwater plume has migrated in an eastward direction. The Arapahoe Number 1 Sandstone subcrops in the Solar Ponds area. If the sandstone is continuous to North

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Walnut Creek, it may provide a conduit for contaminants to discharge to surface water.

Extent of Free-Phase Contamination

The impermeable claystone bedrock limits the vertical migration of the carbon tetrachloride, and the relief on the bedrock surface controls the extent of the free-phase plume. The top of bedrock surface prior to construction of Building 771 sloped to the northeast away from IHSS 118.1, and was approximately 10 to 15 feet below ground surface. Excavation during construction of this building apparently altered this surface, as the recent field investigations encountered the claystone surface 10 feet or more below where it was expected. Excavation may have either increased the slope of the bedrock surface, or created a depression in the bedrock next to the building. Installation of the carbon tetrachloride tank, and the Tank Systems, also required excavation into bedrock, probably creating localized depressions in the bedrock surface.

Very few data points are available to determine the present configuration of the bedrock surface. However, a bedrock surface contour map of this area using all available data is shown on Figure 1. It appears that the excavation for the Tank Systems is the dominant bedrock surface feature in the area. It is assumed that the construction to install the Tank Systems excavated as little material as was necessary to meet the requirements of safety and to minimize costs and waste. This probably resulted in a minimally sloped, steep-sided excavation 10 to 25 feet wider than the Tank Systems, with a bedrock surface approximately 10 to 20 feet deeper than the surrounding area.

The excavation for the Tank Systems was completed in 1955, prior to installation of the carbon tetrachloride tank in 1977. The excavation is deeper and immediately east of the former location of the carbon tetrachloride underground storage tank (Figure 1). The east-west cross section for this area (Figure 2) shows the relative position of these tanks.

The extent of free-phase carbon tetrachloride cannot be accurately determined as it is not known how much material was released into the area, and the bedrock surface is poorly defined. However, the carbon tetrachloride resulting from surface spills during filling, and leakage from the underground tank is expected to have migrated downward towards the bedrock surface. This material would most likely have ended up within the closed bedrock low caused by excavation for the Tank Systems. If sufficient carbon tetrachloride was released to fill up this bedrock depression, then the additional carbon tetrachloride would be expected to flow towards Buildings 771 and 774 along the bedrock surface created during construction of these buildings (Figure 3). Lateral movement of the carbon tetrachloride to the north is expected to be controlled by the south walls of the buildings, and the contaminant may be slowly removed by seepage into the buildings' footing drain systems.

The utility map for this area (Figure 4) indicates a potential for the carbon tetrachloride to migrate along the numerous underground utilities corridors in this area. The most likely utility pathway is a process waste line leaving the Tank System and running eastwards at a depth of 6 to 8 feet. In addition, a vitreous clay sanitary sewer line is found 20 feet north of the carbon tetrachloride spill also at a depth of 6 to 8 feet below surface. The slope of neither line is known, however, the process waste line must slope to the east as it leaves the tanks, and the sewer line should slope eastward towards the Sewage Treatment Plant.

If the entire excavation surrounding the Tank System is saturated with free product, excess free product could overflow to the east into the excavation for the process waste line. This pipeline runs eastward towards the Solar Ponds Area and may be a pathway to this area. However, as the pipeline is located within fill above bedrock, the carbon tetrachloride would tend to migrate downward from the pipeline excavation towards the bedrock surface, leaving behind limited residual DNAPL as a reduced source for ground water contamination. Since most pipelines at RFETS are backfilled with native materials, both the process waste line and the vitreous clay sanitary sewer line are probably also backfilled with uncompacted native materials. Native backfill should be more permeable than surrounding undisturbed material. The clay-rich nature of the backfill should to some extent limit migration of contaminants, but water leaking from these pipelines could enhance migration of the dissolved phase of the groundwater contaminant plume.

The sanitary sewer pipeline near IHSS 118.1 is probably not a significant conduit for contaminant migration. Some of the carbon tetrachloride spilled at the surface could have been captured within the excavation for the sanitary sewer pipeline. However, this pipeline is not

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within the predicted flow path for leaks from the tank, and when the free product from spills dissipated or settled to the bedrock surface, the source of carbon tetrachloride to this pathway was also reduced or eliminated.

While the utilities in this area are probably conduits for eastward transport of the dissolved phase of the groundwater plume, free phase carbon tetrachloride is probably not currently migrating along these pathways. This is substantiated by the decreasing contaminant concentrations in the groundwater at well P210189 (near the Solar Ponds), indicating that the contaminant source is attenuating.

Conclusion

Most of the carbon tetrachloride resulting from surface spills and leakage from the underground storage tank is expected to have migrated downward into the excavation surrounding the Tank Systems. If sufficient material was spilled to completely fill this excavation, the excess material is expected to flow eastward possibly along the process waste line excavation, and also toward Buildings 771 and 774. Based on existing borehole data, Figure 1 depicts the minimal expected extent of free product in this area. Figure 3 depicts the maximum extent of free product in the vicinity of IHSS 118.1. Differences between these maps are based on the amount of carbon tetrachloride spilled.

The minimum expected extent is based on the assumed size and location of the excavation for the Tank System, and the behavior of carbon tetrachloride in the subsurface. Depending on the size of the excavation, and the volume of material spilled, there is a possibility that carbon tetrachloride has overtopped this excavation and spread out as a much larger contaminant plume to the north and south. The extent of the free product would be controlled by bedrock structures, utility corridors and variations within the fill and alluvium.

Recommendations for Future Work

Pre-remedial investigation of the extent of free-phase contamination is recommended, followed by source removal as practicable, and as funding allows. This investigation should include investigation whether free-phase carbon tetrachloride is present within the utility corridors, particularly in the excavation for the process waste pipeline near IHSS 118.1.

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A limited investigation should be conducted to determine if the footing drains in the area are preferential pathways for carbon tetrachloride migration into the buildings. The footing drains may be controlling the extent of the dissolved phase of the carbon tetrachloride plume. Elevated levels of carbon tetrachloride, if present, could pose a threat to current building workers or workers during demobilization and deactivation.

Pre-remedial investigation of the dissolved phase of the groundwater plume is recommended to determine the source(s), and to optimize the siting of any required groundwater cleanup actions. The investigation should also explore the extent of contamination in the Arapahoe No. 1 Sandstone in the Solar Ponds area, and determine whether it could be a conduit to surface water. Mitigation of these pathways may be necessary to prevent impacts to surface water quality.

References

DOE, 1992, *Final Historical Release Report for the Rocky Flats Plant*, U.S. Department of Energy, Rocky Flats Plant, Golden, Colorado, June.

DOE, 1995, *Draft Data Summary 2, Operable Unit No. 9, Outside Tanks*, October 1995.

RMRS, 1996, *Revised Groundwater Conceptual Plan*, September 1996.

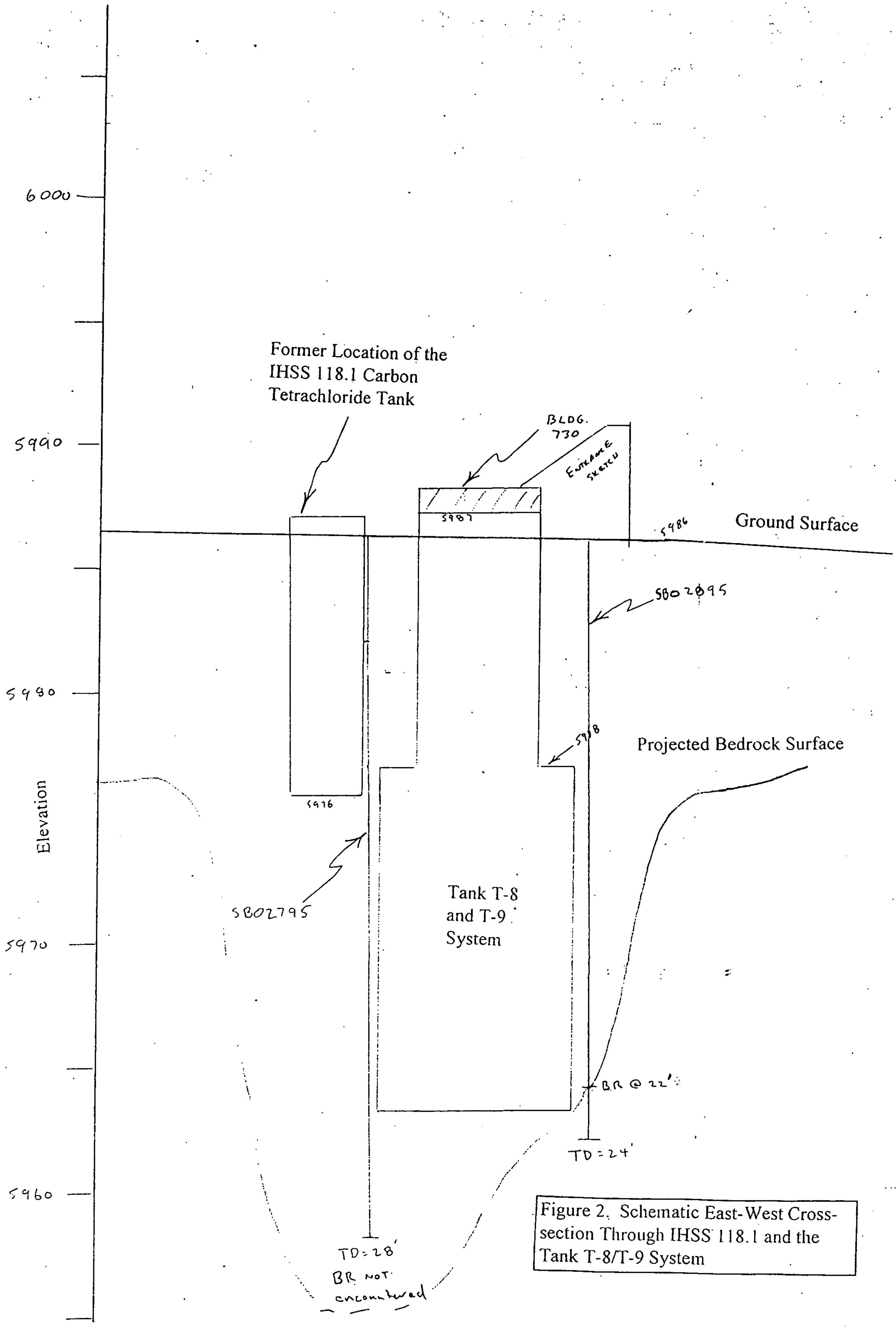

Figure 2. Schematic East-West Cross-section Through IHSS 118.1 and the Tank T-8/T-9 System

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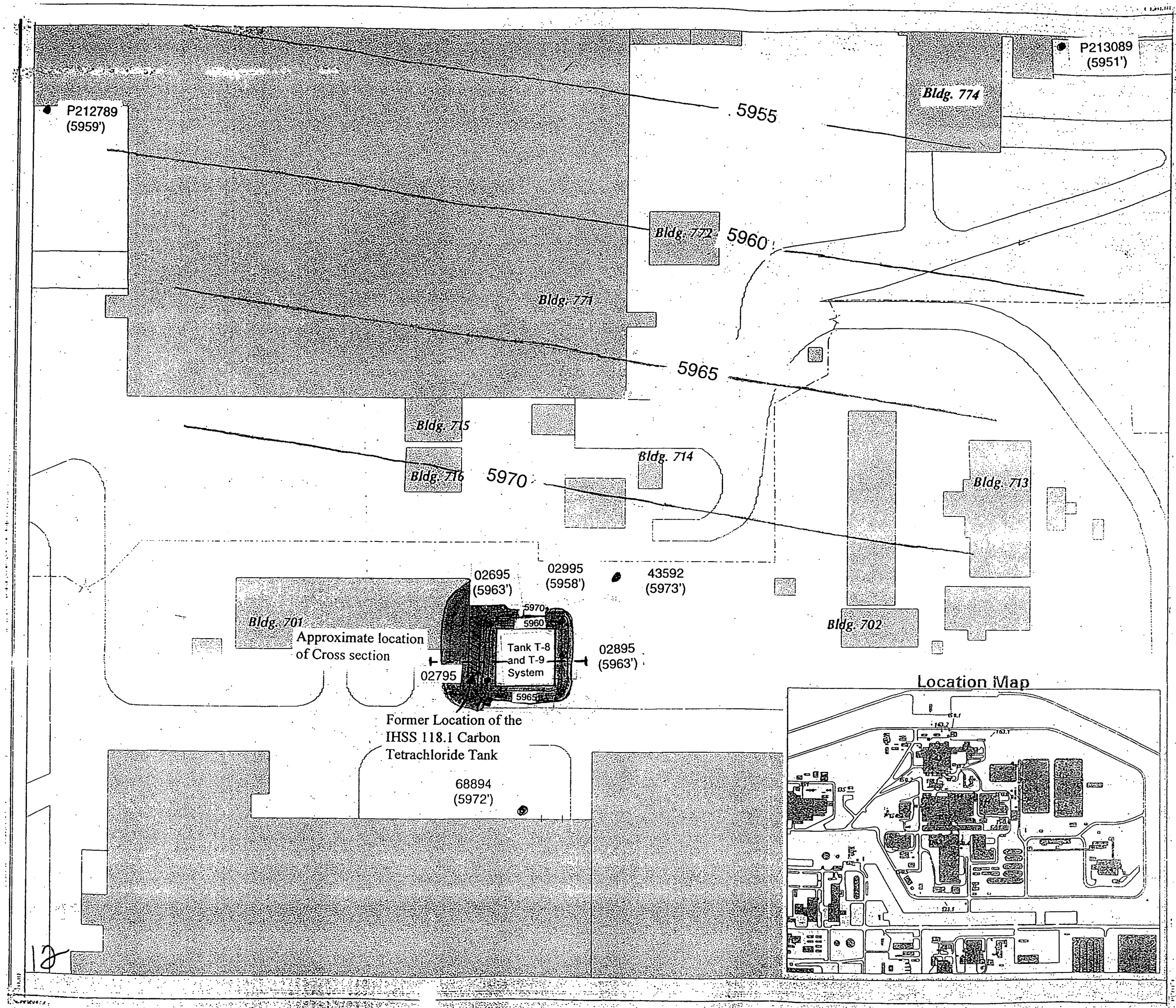
IHSS 118.1
Carbon Tetrachloride Spill

Figure 1

Estimated Minimum Extent of DNAPL Plume



Buildings or other structures

Building footprint (where overlaps IHSS)

Fences

Paved roads

Dirt roads

Well Number (Top of Bedrock Claystone)

Top of Bedrock Surface Contours

Estimated Extent of DNAPL

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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Site

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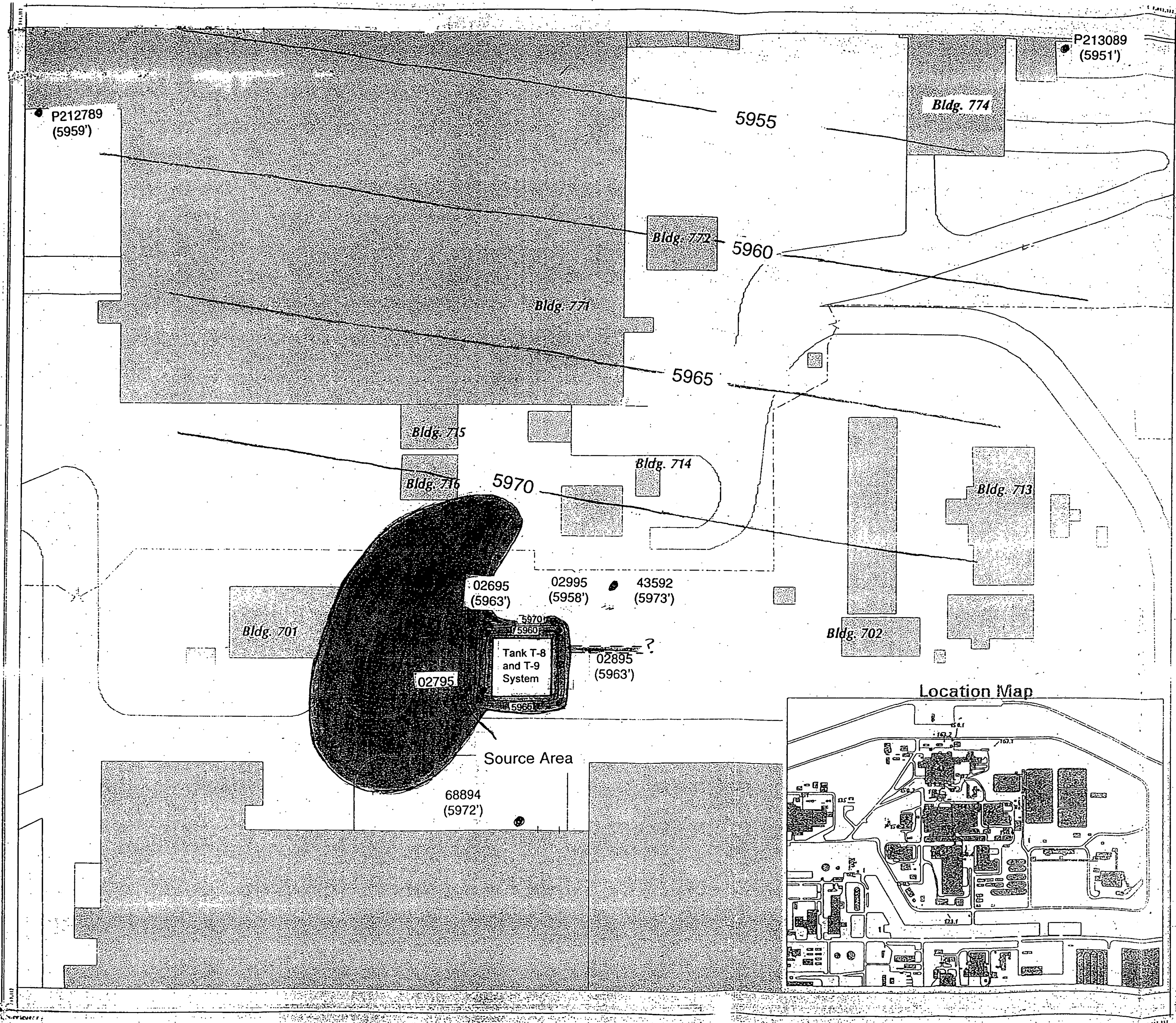
IHSS 118.1 Carbon Tetrachloride Spill

Figure 3

Estimated Maximum Extent of DNAPL Plume



Buildings or other structures

Building footprint (where overlaps IHSS)

Fences

Paved roads

Dirt roads

Well Number (Top of Bedrock Claystone)

Estimated Extent of DNAPL

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

Rocky Mountain Remediation Services
A Limited Liability Company
7100 East Belleview Avenue, Suite 300
Englewood, Colorado 80110

RMRS

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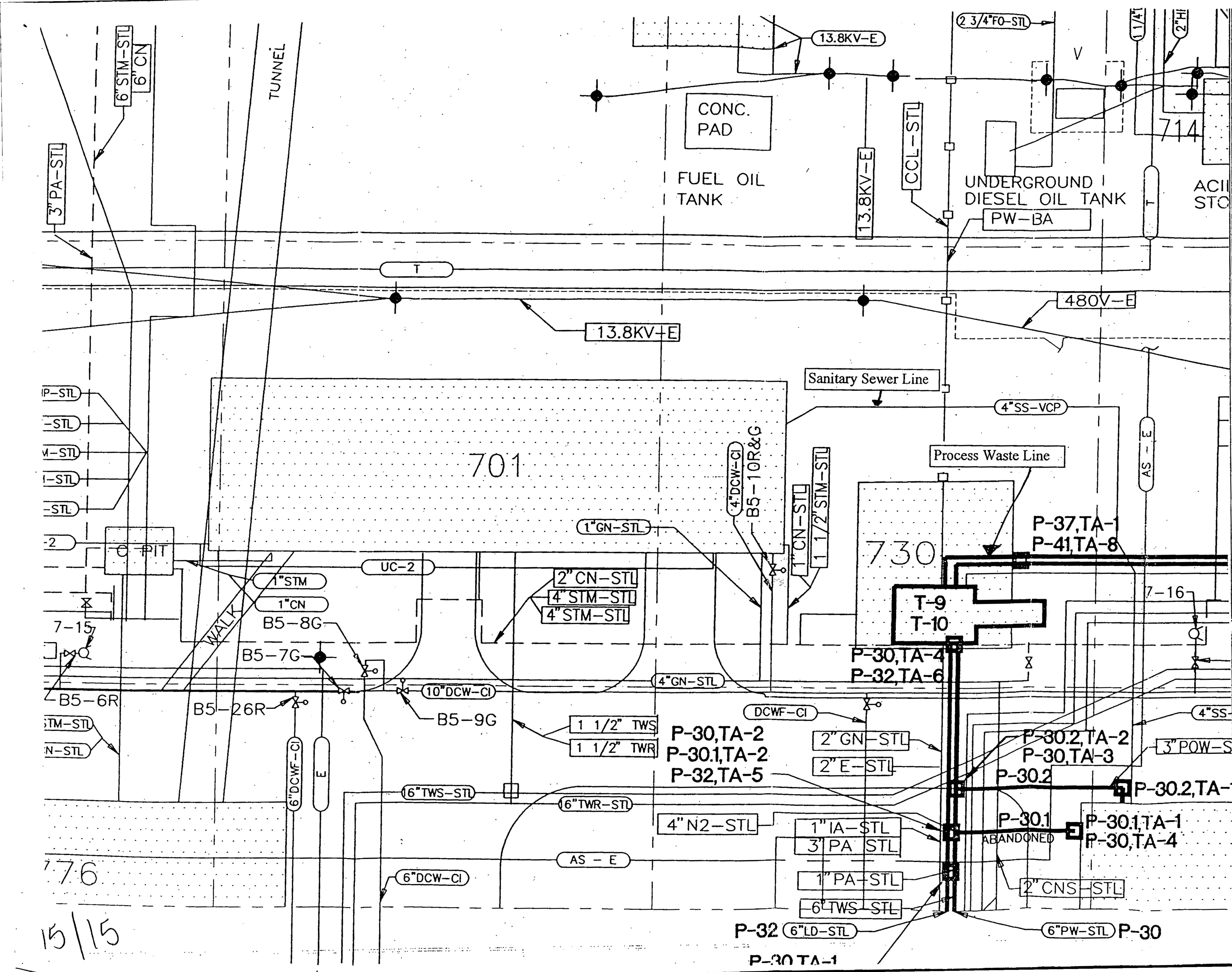

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IHSS 118.1
Carbon Tetrachloride Spill

Figure 4

OPWL Utility Location Map
Original Process Waste Lines

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MAP ID: ou-8

August 21, 1996